ISSUE 1 / 2012

DATA – FACTS – ANALYSIS

CUTEC-News

COCI TECHNOLOGY TRANSFER AWARD

BEST WISHES FOR 2012

PROCESS-CENTRIC BIOMASS ASSESSMENT

As exploitation of renewable energy continues to expand, biomass will have an increasingly important role to play, particularly in distributed power generation schemes. Most biomass power generation / heating systems are based on wood derivatives such as chips, pellets and logs. Despite the fact that Germany has Europe's largest timber stocks in absolute terms, there is a growing imbalance between supply and demand and prices continue to rise. However, the country has a rich and diverse flora and an advanced agricultural industry. Both are a source of non-wood biomass and biomass residue which can be used for power generation and production of raw materials. The number of biomass power / CHP stations has increased significantly in Germany in recent years. According to figures put together by IE Leipzig*, 162 power stations were operating in 2006 with a total installed generation capacity of 1,094 MW_{el}. Nearly 100 of them were at the low-end of the scale (< 5 MW_{el}).

Different types of biomass

Up to this point, operators have by and large taken an empirical approach to expansion of the fuel base. As a result, the applicability of the solutions is limited to the local operating environment. A process-centric compendium of expertise relating to the combustion, gasification and pyrolysis of different types of biomass does not exist, but it will be needed in order to create guidelines for the selection of substitute fuels and to facilitate cost management. This type of process-centric expertise already exists for coal-fired power stations, and it is based on extensive research as well as many years of practical experience. Due to its characteristic composition, biomass exhibits totally different behaviour, and the criteria used for the combustion of solid fossil fuel are not directly applicable to biomass-based power generation. Users are unable to present a set of coherent requirements criteria to fuel suppliers, and fuel suppliers cannot offer a range of defined product types which would help them develop new markets.

Four well-established research institutions are currently working on the development of criteria to support a process-centric approach to thermal power generation, an extension of the fuel base to include residue from a variety of sources and exploitation of new lignin-rich energy crops. The four institutions are: KIT (Karlsruhe Institute of Technology – Institute for Technical Chemical Chemistry), TUD (University of Applied Sciences Dresden – Chair for Combustion, Heat and Mass Transfer), Clausthal University of Technology (Dept. of Energy Process Engineering and Fuel Technology) and the CUTEC Institute (Thermal Process Technology Dept.) (see illustration below). The application was submitted via the GVT process engineering association to AiF** under the umbrella of a joint industrial research and development programme funded by the Federal Ministry of Economics and Technology. Following approval of the application, the project was launched on July 1st, 2011 and is scheduled to run for 30 months. 14 companies along with FNR*** and GVT as guests are members of the project advisory committee.

The companies are from the EPC, chemical analysis, biomass production (agricultural, forestry and industrial) and energy supply industries. The CUTEC Institute has overall responsibility for project coordination. There is significant public interest in issues which are being addressed by the project, and expectations are high. Watch this space, as there will undoubtedly be some interesting developments to report in CUTEC News over the next couple of years. (vo)

Logos of the project partners

*Leipziger Institut für Energie GmbH, **Arbeitsgemeinschaft industrieller Forschungsvereinigungen "Otto von Guericke", ***Fachagentur Nachwachsende Rohstoffe e.V.

COCI TECHNOLOGY TRANSFER AWARD

CUTEC and aquen are the 2011 award winners

Photo: Peter Pohl

The two award winners, Prof. Otto Carlowitz (left) and Dr. Christian Schröder, in front of a FlocFormer

Prof. Otto Carlowitz and Dr. Christian Schröder were the recipients of the €10,000 Technology Transfer Award 2011 sponsored by the Braunschweig Chamber of Commerce and Industry. They received the award for passing technology on to a start-up company. A number of invited guests attended the ceremony on November 18th. The second recipient is a former scientific assistant who founded aquen aqua engineering. The company was the first CUTEC spinoff, and its business activities are primarily based on development work carried out at CUTEC between 1996 and 2007 on an innovative process for optimising sludge treatment from both the ecological and cost standpoints. The development path led from lab apparatus right through to marketable products. The FlocFormer flocculation reactor and the FlocSens instrumentation system are the transfer products. Aquen is responsible for production and worldwide sales. CUTEC is the sole shareholder and patent owner. Users of this technology can optimise sludge treatment by using both products together as a process unit. The FlocFormer flocculation reactor is based on a regulated, multi-stage flocculation process, and it has created a unique selling proposition for the world market. The product treats the sludge flocs so that they are ideally conditioned for standard downstream dewatering equipment such as chamber filter presses, belt filters and decanters. Conditioning increases dewatering performance by as much as 30%. The reactor is augmented by the FlocSens photo-optical detection system with CCD line-scan camera. The FlocSens provides online floc analysis functionality to support monitoring and control of the dewatering process. Aquen specialises in sludge and effluent treatment and polymer-initiated separation. The company's innovative products and solutions help customers to significantly improve the efficiency of the disposal and dewatering process. Reduced sludge disposal volumes and lower polymer consumption save money, and as a result users see a quick payback on their investment. Less sludge needs to be transported by road. Also, since the sludge is drier when it reaches the incinerator, the energy yields are higher. All of this is good news for the environment. Two employees moved from CUTEC to aquen when the company was founded in 2008 to provide production and admin support. Three years later, the company has six employees. The future looks promising. Dr. Schröder expects turnover to reach €1.5 million next year, double the current figure. “Nationwide, 2,300 of the roughly 10,000 municipal water treatment plants have benefited from the FlocFormer, saving something in the region of € 80 million a year,” said the company founder. Besides the water treatment sector, the technology can in principle also be used in the paper and chemical industries.

Photo: Peter Pohl

Prof. Carlowitz during his address

When asked how often this type of technology transfer takes place, Prof. Carlowitz said the following: “Technology transfer is nothing unusual at a research institution like CUTEC. It usually remains hidden from the public view, because at the end of a joint development process a marketable product is simply added to the portfolio of the industrial partner which was involved in the project."

Continued on page 4

Photo: Peter Pohl

CoCI President Schmid (far left) and Jury Chairman Prof. Werner Gramm (far right) presented the awards to the two recipients (centre)

MEP PAYS A VISIT TO CUTEC

Gesine Meißner consults with experts on resource efficiency during a fact-finding mission to the Harz region

MEP Gesine Meißner and her staff visited CUTEC on Friday, October 14th, 2011. Resource and energy efficiency was the main item on the agenda during the visit. In his introductory remarks, Prof. Carlowitz left no doubt that industrial production will have to become more resource and energy efficient and that power generation will have to run at maximum efficiency if the Federal Government is to achieve its aggressive CO2 and resource conservation targets.

A steel scrap dezincing project is one concrete example which shows how this can be done. Prof. Gock from the Disposal Research Institute at TU Clausthal originally came up with the idea which was then carried forward by the CUTEC Sustainability Management cluster (CNM). The cluster also brought Volkswagen on board.

The innovative dezincing process reduces energy consumption and CO_2 emissions by around 80% compared to the conventional method.

Concerns about current education and research policy were also expressed. Prof. Carlowitz sees room for improvement in the Bachelors and Masters courses. As things stand now, students "commit a lot of knowledge to memory", but the courses do not really challenge the prospective engineers to "put what they have learned into practice." Looking at the world of research, it was suggested that parallel development should be allowed with a view to choosing the best alternative. The application process also needs to be streamlined. The current system often discourages the formation of process-specific research networks and consortiums which are ideally suited to the task at hand. Gesine Meißner and her team were visibly impressed by the diversity of activities undertaken by CUTEC. She suggested that Prof. Carlowitz act as CUTEC's "ambassador" in Brussels, and she invited him to visit her office. (sr)

Photo: Andre Bertram

Gesine Meißner (centre) and Prof. Calowitz (right) in front of the dezincing system at CUTEC

May you find peace
Amid the din and the clatter
The noise is nothing but torment.
May you find a few moments
To spend time just with yourself.

May you find peace.
Can you remember what that's like?
Don't let things
Reach the point
That you don't even miss it.

May you find peace
To preserve your strength,
To pause for a moment, to catch your breath,
Silence must reign.

May you find peace
Before the uproar of the world
Makes you deaf and lethargic,
Go into the woods,
Leave the city behind you,
Or lock yourself in
To regain your serenity.
When you are weary,
Find recourse in silence.
Peace alone
Will heal you again.

(Elli Michler)

The CUTEC editorial team wishes all of you a Happy New Year

Continuation from page 3

CoCI Technology Transfer Award

The Braunschweig CoCI has been sponsoring the Technology Transfer Award since 1985, and this is the 4th time over the course of the 27 years that the accolades have gone to Clausthal. This year's keynote speaker Prof. Thomas Hanschke, who is the Steering Committee Chairman at NTH (Lower Saxony University of Applied Sciences) and President of TU Clausthal, provided a progress update on the academic partnership programme which operates under the NTH umbrella. In the laudation that followed, Jury Chairman Prof. Werner Gramm introduced the award winners to the audience and explained the reasons why this particular technology transfer, which was exemplary in every respect, was selected to receive the award. The two award recipients subsequently had the opportunity to say a few words. Prof. Carlowitz explained the technology transfer process from his perspective. Dr. Schröder provided an insight into the sludge treatment flocculation process and outlined the scope of his company's business activities. CoCI President Dr. Wolf-Michael Schmid then presented the awards. A press conference was held one hour prior to the award ceremony to share information with the media about this year's award recipients. More information about this year's award and a brief history of the Technology Transfer Award is available on the Braunschweig CoCI homepage. (he)

DIN EN ISO/IEC 17025:2005 ACCREDITATION

Baptism of fire for monitoring station and lab

You may have heard of accreditation (licensing) in the world of journalism and sport, but what does accreditation mean with reference to technical/scientific services? Someone with a good knowledge of Latin can help clarify the etymology. The word "accredere" means "give credence to". This is exactly what customers and partners expect from the §26 BImSchG (Federal Emission Control Act) compliant monitoring station. They have to be sure that they can rely on the measurements and analysis results. Routine measurements to verify compliance with emissions limits can determine whether a facility will be allowed to continue operating or not. As a result, the monitoring station has very substantial responsibility for protecting humans, animals and the environment from the harmful effects of pollution. On the other hand, the measurement results can lead to a government-mandated shutdown which can cost the operator a lot of money. Process licensing, which is mandatory for German monitoring stations, is a very important quality assurance tool for this highly sensitive data collection and analysis function. This also applies to the second major function of the monitoring station, namely the determination of exhaust gas parameters for energy optimisation in industrial processing. Besides the availability of alternative, sustainable power "generation", constant improvement in the energy efficiency of existing processes will also be an essential element of the energy transition. To improve process sustainability, you first need to understand the process and that includes a definition of the emission parameters.

Measurement station: looking for signs of dioxin

Analysis lab: Testing by the experts

What makes a monitoring station "credible" and how does the licensing process work for monitoring stations and labs? The guidelines have been laid down in an EU Directive. DAkkS, which has its head office in Berlin, is the sole German agency with licensing authority, and applications must be submitted to that organisation. The first step is to define which activities are to be covered by the license. For us, that means the following: Category A includes emissions measurement for organic gases such as sulphur dioxide, nitrogen oxides, hydrogen chloride, etc. Category D includes the measurement of dust emissions and heavy metal content in those emissions. Category I includes organic compounds such as the BTEX aromatics as well as formaldehyde, the PAHs which form during incomplete combustion and total carbon content. In Category M, sampling of ultra-poisonous PCDD/PCDF "dioxins" is relevant to us.

After submitting a large set of quality management, measurement data acquisition and test report generation documentation, we had mixed feelings as we awaited the 4-day assessment at the CUTEC lab. When you are dealing with this level of complexity, you always have the feeling that doing just a bit more would help you sleep better.

The assessment took place at the end of August. Two DAkkS assessors came on two different occasions to scrutinize our operations. After comparing the quality assurance documentation with the requirements list, they took a look over our shoulders as we conducted an emissions test at a customer site: is the accuracy of the weights traceable, are the micro pipetting work areas clearly marked, are the balances checked on a regular basis, is defective equipment marked and segregated, is standard reference material used, are the responsibilities of the team members clearly defined, is training provided on a regular basis and are standard work procedures periodically reviewed and updated?

The number of deviations noted by the assessors increased in direct proportion to our level of fatigue. The under-the-breath comments ranged from "why didn't we think of that" to "why is he making such a big issue of a small thing like that". However, the exit discussion raised our spirits again. The assessors informed us that we would be recommended for accreditation, and we received the coveted certificate on November 23rd, 2011. (fi)

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ENERGY CONSULTANCY IN JAMAICA

Providing EU consultancy on biomass power generation to the Jamaican Ministry of Energy

Bagasse is the pressed fibre by-product which is left over when sugar is produced from sugar cane. The bagasse is burned to generate steam at the sugar factory. The steam drives the mill and the turbines which generate electricity, and it is also used for boiling and evaporation in the downstream sugar production process. There is normally sufficient bagasse to supply the entire energy needs of the sugar factory. If highly efficient state-of-the-art technology is deployed, a significant amount of excess electricity can be generated and exported.

The Jamaican sugar industry is currently in a state of transformation. Guaranteed EU import volumes and prices no longer exist. The EU is providing financial support to assist the sugar industry in the country as it adapts to the new situation. One of the many aspects involved in the transition is an investigation to determine what contribution the sugar industry can make to meeting Jamaica's electricity needs (based on models like Brazil, Mauritius and Thailand).

CUTEC was selected as a subcontractor by an English consulting firm for a study entitled "The Use of Biomass and Cogeneration in the Jamaican Sugar Industry". CUTEC had the advantage that Mr. Siemers had conducted similar studies in Thailand and, more than 20 years ago, in the Caribbean as well. Mr. Siemers was in Jamaica from the middle of August until the beginning of October to conduct interviews and visit the factories.

As expected, the findings indicated that the current energy situation in the sugar factories is unlikely to produce the desired outcome. The equipment in use can best be described as "post-war" technology. The steam generators operate at 15 – 20 bar. There is no combustion control or measurement of data, and the steam is not being used very effectively. Instead of energy autonomy, the factories also have to rely on heavy fuel oil or electricity from the grid to fully meet their needs. However now that the industry has been privatised, capital has become available to modernise the factories. We identified opportunities for investing in biomass power generation at the various factories. By increasing efficiency, more electricity can be produced which can be fed into the grid. As sugar production is only in operation for 6 months a year, the possibility of using additional biomass to generate electricity throughout the entire year was also investigated.

Successful use of a high-yield sugar cane variety which has a high fibre content

Besides technical feasibility, the economic framework is of course also crucial for the success of projects like this. Unlike Germany, Jamaica unfortunately has no renewable energy law. The power company is prepared to pay in the region of 11 – 12 USct/kWh for feed-in electricity. The price would have to be at least 15 USct/kWh to allow biomass power station operators to cover their costs. The industry has to pay (what in Germany would be an unbelievable) 29 USct/kWh for delivered electricity. The task now is to use the study carried out by CUTEC/ Mr. Siemers to convince the Ministry of Energy to increase the price paid for feed-in electricity. The short-term potential of biomass power generation is around 5 % – 8 % of total generation capacity in Jamaica. Currently, electricity is produced at relatively old power stations which are totally dependent on (expensive) imported heavy fuel oil and diesel. Besides the economic benefits, successful deployment of biomass generation technology would be good news for the environment and the world climate.

A second mission to Jamaica is planned from mid-November to mid-December to present and discuss the results. Besides technical and financial details relating to power generation, the agenda will also include plans for making additional biomass available. The list of possibilities currently under consideration include the use of high-fibre sugar cane varieties, cultivation of energy cane or other energy crops in the off season and the establishment of short-rotation forestry plantations. The final report is due for completion at the end of December.

(sie)

VISITORS FROM CHINA

Electricity grid operator from southern China visits CUTEC and tours the energy park

Mr. Siemers and other members of the CUTEC team with the support of IEE* hosted a 10-member delegation from China on November 1st, 2011. While in Europe, the group of travellers from China Southern Power Grid Co. Ltd., which has its head office in Guangzhou, was particularly interested in learning more about the development of renewable energy and the effects it is having on the electricity grid.

The German consultant who was involved in the delegation's tour recommended a visit to CUTEC which has been operating the Clausthal Energy Park for quite some time to demonstrate the combined use of renewable energy in a local grid. Following an introduction to the theoretical aspects and a lively discussion on the results obtained at the Energy Park, the visitors took a first-hand look at the different components. The Chinese guests were visibly impressed with the technological diversity and the innovative approach.

(sie)

*TU Clausthal, Institute of Electrical Power Engineering

AIR QUALITY ANALYSIS AT THE GOSA LANDFILL SITE IN ABUJA, NIGERIA

A CUTEC project, part of a long-term environmental partnership with the city of Abuja.

The scientific partnership between the city of Abuja and CUTEC goes back nearly 10 years. Since 2006, CUTEC has been acting as the official environmental consultant for matters relating to "waste disposal assessment", "development of a sustainable waste management strategy", "environmental audits" and "environmental legislation".

An initial benchmark analysis of air quality has been carried out as a subproject at the Gosa landfill site. A brief summary of the environmental situation appeared in the December 2009 issue of CUTEC News. Data was collected during both the dry and rainy seasons for qualitative and quantitative assessment of the gas constituents. Analysis work was carried out locally and at the CUTEC lab in Clausthal. Some problems were evident as soon as the samples were taken. The results revealed evidence of dioxin contamination, hospital waste and methane gas escaping from the ground.

The analysis showed that a variety of gas constituents generate air pollution over a wide area. The pollution extends beyond the boundaries of the landfill site, affecting adjacent areas that are used for other purposes. The list of problematic substances includes carbon monoxide, benzene, toluene and hydrogen sulphide. 50 different compounds were detected in other samples, some of which are hazardous/carcinogenic. Mixed land usage (urban, agricultural and industrial/commercial) within a relatively small area creates health hazards for humans and animals as well. The fact that the population is permanently exposed to these health hazards exacerbates the situation.

Photo: Michael Struve

Mixed land usage (waste disposal and agriculture)

Photo: Michael Struve

Air quality analysis

The report addresses a variety of options for managing the existing disposal site. It discusses the effectiveness of each option and the associated costs. Prohibiting access over a wide area would be a feasible short-term way of minimising the human health hazards, but it would not solve the real problem. Proper clean-up at the site is the only approach which would get to the root of the environmental problems. Further investigation and planning would be needed to do that, and it would only be feasible in the medium term.

Other options were discussed when Dr. Onyeche handed over the report to Senator Bala Mohammed, Minister of Abuja Federal Capital Territory, by the Permanent Secretary. A holistic waste collection and recycling strategy would be advisable over the medium to long term to make a sustainable contribution to resource conservation. The productive partnership between CUTEC and the FTC Administration in Abuja will continue on into the future. (me)

REPORT FROM THE WORKERS COUNCIL

Following the reconstitution of the Workers Council a year and a half ago, the time has come for a brief interim report. The normal responsibilities of the Workers Council include employee representation, monthly meetings with Senior Management and involvement in the hiring process. We have also achieved resolution on one issue, hopefully to the satisfaction of all CUTEC employees. It took us a long time to get there, but a uniform overtime compensation policy for all employees is now in place.

The Workers Council has also been involved in the on-going organisational development process. Among other things, a procedure has been defined for the hiring process. It encompasses the definition of human resource needs as well as job postings, job interviews and new hiring. The process continues with orientation to familiarise new employees with the major infrastructure at the Institute. The idea is to make sure that everyone involved is brought "on board" at an early stage and to ensure the best possible flow of information to new employees.

The Workers Council also continued to analyse the responses and suggestions relating to "optimisation of interdepartmental communications" which is an on-going development process. Due to the need to address a certain number of "pressing issues", this project has moved somewhat into the background recently, but the Workers Council intends to devote more attention to it in the near future and bring it to a conclusion.

The Appointment Committee, which is charged with finding a replacement for the current Managing Director, has met several times. CUTEC employees are represented on the Committee. The Workers Council had made a concerted effort to ensure that this was the case. (cro/da)

4TH LOWER SAXONY FUEL CELL SUMMER SCHOOL A BIG SUCCESS

The Summer School 2011 students following an interesting and informative week

The Lower Saxony Fuel Cell and Battery Technology Summer School has developed a nation-wide reputation as an annual event which generates interest among the younger generation in new technology.

The Summer School organised by the State Fuel Cell and Electromobility Initiative, CUTEC and the TU Clausthal Environmental Science Institute was staged for the 4th time this year. Prof. Beck hosted the event at EFZN in Goslar. Suitable conference rooms, some initial fuel cell and battery technology exhibits and fuel cell kits were available at the energy research institute. Companies such as EWE, IAV, H.C. Starck and Volkswagen along with the universities in Braunschweig, Clausthal, Hannover and Oldenburg played their part by providing presentations and excursions. Students and doctoral candidates (nearly 50 in all) booked all of the available places. Attendance by young people from Lower Saxony, Bremen, Darmstadt, Dresden, Erlangen, Karlsruhe, Konstanz, Magdeburg, Mainz, Munich and Stuttgart clearly indicates that the excellent reputation of Summer School extends well beyond the state's borders. The message is obviously spreading that the Summer School offers real quality and a great atmosphere. The consensus following a week of lectures, practicals, discussions and the generation of presentations was overwhelming and unanimous: "great credit is due to the organisers and sponsors, great lectures covering a wide range of topics, very good mix of information from the research and industrial communities." The 5-day Summer School kicked off with introductory presentations on fuel cells, redox flow systems, metal-air cells and batteries, and there were also presentations by members of the State Initiative, namely Sperlich, EWE and Volkswagen. The basic science behind Proton Exchange Membrane (PEM) fuel cells and Solid Oxide Fuel Cells (SOFC) and battery technology was presnted by Prof. Beck, Prof. Endres, Prof. Turek, Prof. Wenzl and Dr. Dörrer (TU Clausthal), Mr. Bardroff (NextEnergy), Mr. Haselrieder (TU Braunschweig) and Dr. Lindermeir (CUTEC). Dr. Meier-Haack from the Leibniz Institute of Polymer Research in Dresden gave an update on current development trends in the field of fuel cells membranes. EWE, H.C. Starck, I+ME Actia, Johnson Controls, Volkswagen and W. Eisenhuth provided information on the practical aspects as seen from the perspective of the Lower Saxony industrial community. Companies based in Hamburg (Airbus Operations), North Rhine-Westphalia (Ceramic Fuel Cells and Hoppecke Batterien), Mecklenburg-Western Pomerania (new enerday) and Saxony (Staxera) also emphasised the relevance and attractiveness of this technology. EFZN procured a set of fuel cell training kits specifically for the Summer School. Course participants working under the direction of CUTEC employees were able to gain hands-on experience with fuel cells and electrolysers. The TU Clausthal Institute for Chemical Process Engineering designed and built kits for use during the battery technology experiments, as suitable training material is not commercially available.

Excursions were also organised to the research facilities at Volkswagen in Isenbüttel, IAV in Gifhorn, the Metallurgical Institute in Clausthal and the CUTEC Institute, giving participants the opportunity to gain additional practical experience. The various groups then put together their own presentations for the other course participants, describing their trials and drawing some conclusions from the results obtained. After a week filled with the basic scientific fundamentals, current research results and highly interesting hands-on experience, the course participants were in a better position to decide whether they might want to specialise in fuel cell and battery technology in the future. Lower Saxony is leading the way by giving young members of the academic community a greater insight into technology which will play a major role in the Fuel Cell and Electromobility Initiative and by providing an avenue of contact with the world of science and industry. The course participants, organisers and speakers found the experience so rewarding that they definitely would like to see the event continue. The next Summer School will be held in 2012 at NEXT ENERGY in Oldenburg. Preparations will begin shortly. (di)